Synthesis, structure and dynamics of block copolymer based organic-inorganic hybrid materials

Ulrich Wiesner, Cornell University, DMR-0072009

Polymer based nanostructuring of ceramic materials holds tremendous scientific and technological promise, leading, e.g., to high surface area materials with applications in catalysis, sensing, fuel cells, and filtration. Combining block copolymers as structure directing agents with sol-gel chemistry, these materials form a unique interface between polymer and inorganic constituents at the molecular level through a self-assembly process, thereby eliminating the need for expensive equipment based top-down approaches to nanostructured materials.

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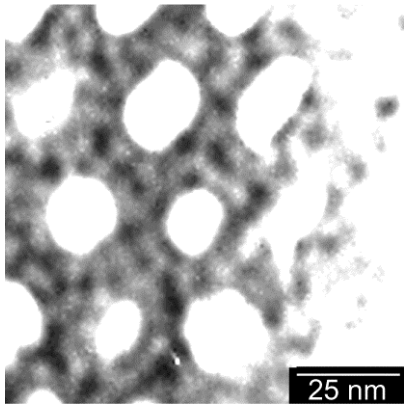
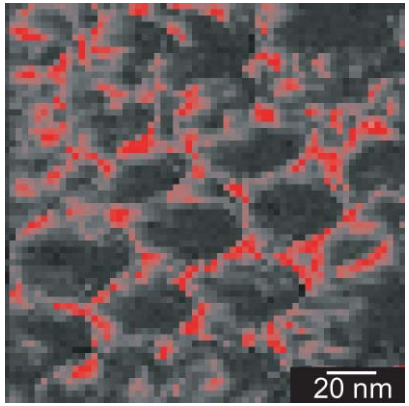


TEM showing iron oxide particles (dark spots) embedded in a mesoporous (hexagonal) aluminosilicate matrix.



Elemental map showing the iron distribution in these materials using a STEM and electron energy loss spectroscopy (EELS).

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Education:

Three postdoctoral researchers (Adam C. Finnefrock, Jochen S. Gutmann, Peter F.W. Simon), four graduate students (Surbhi Mahajan, Carlos B.W. Garcia, Marc Langela, Ralph Ulrich), and ten undergraduate students (Marybeth Faught, Christopher Curry, Deirdre Johns, Jeffrey Biser, Heather Chapman, Vikram Joshi, Kyong Park, Conrad Lovell, Jennifer Ruglovsky, and Eric Verploegen) took part in this grant.

Outreach:

In 2003, through the Cornell Center for Materials Research (CCMR) we collaborated with the Ithaca City School District to present hands-on learning modules to 140 K-5 teachers.

Graduate student Surbhi Mahajan paired with an elementary school teacher presented units addressing topics from materials properties to electromagnetism. Teachers then discussed ways of incorporating these units into their classroom.